DGR ENGINEERING

WATERTOWN SERVICE AREA REPORT

PREPARED FOR

SIOUX RURAL WATER SYSTEM

February 2016

DGR Project No. 802810

EXHIBIT

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WATERTOWN SERVICE AREA REPORT

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REGISTERED PROFESSIONAL ENGINEER REG. NO. 7785 DARIN L. SCHRIEVER SOUTH DAKOTA	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly Licensed Professional Engineer under the laws of the State of South Dakota. By Darin Schriever 2/5/16 Darin L. Schriever, P.E. License Number 7785 My license renewal date is July 31, 2016. Pages or sheets covered by this seal: All except Appendices

DGR Project No. 802810

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WATERTOWN SERVICE AREA REPORT

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INTRODUCTION

DGR Engineering has been retained by Sioux Rural Water System to provide a report addressing the service area near the City of Watertown. The report will provide background information on the existing distribution system and the existing water treatment plant which serves the area. The report will also address the proposed improvements project which has been previously identified. Thirdly, the report will address the potential addition of customers in the area.

Professional opinions expressed in this report are based on sound engineering principals and are made to a reasonable degree of certainty. The right is reserved to make other and further opinions and to make clarifications of the opinions if new information is received or in response to questions asked at deposition or in discovery. The biographical information for Darin Schriever, a Professional Engineer with DGR Engineering, is included in Appendix A.

BACKGROUND INFORMATION

It is common for rural water systems to construct the system to provide for certain services and not others. Sioux Rural Water System has chosen to provide water service to meet the potable water demands of domestic, small business and livestock uses in the system. It is also common for rural water systems, such as Sioux Rural Water, to build an initial system with some spare capacity to provide for increased usage and the addition of some new customers. The system is commonly built at a level which is affordable at the present time, but can be expanded in the future as needed. As new service areas develop, new customers are added and/or existing customers use more water, the system can plan for and construct improvements to meet the needs of the water customers.

A Preliminary Engineering Report (PER) was provided for Sioux Rural Water System in March of 2013. A copy of the full report is included in Appendix B. The report provides historical information for the Rural Water System and provides recommendations for improvements. An Addendum to the Preliminary Engineering Report was provided in November of 2014 and is included in Appendix C. The Addendum addresses some modifications to the original PER and the recommended improvements.

The Preliminary Engineering Report and the Addendum identified several locations in the rural distribution system which had potential low pressures during peak usage periods. Pipeline and booster improvements were identified to provide additional distribution capacity to these areas. The improvements project is intended to be bid in the Spring of 2016 with construction beginning in the Summer of 2016 and planned completion by the Spring of 2017. The proposed distribution improvements are identified in drawings included in Appendix D. The planned improvements include approximately eight miles of 8" pipeline generally south and west of Pelican Lake. This pipeline will provide additional water supply and better residual pressures to existing and potential customers in the area.

DGR Engineering has performed hydraulic modeling for rural water systems for over 30 years. The computer software used is called KY Pipe and it performs hydraulic calculations based upon instantaneous peak demand, as well as average demand. The modeling software utilizes a peak demand curve and a demand diversity method to calculate the highest flow rates expected and,

therefore, the lowest residual pressures expected during a peak water usage period. The results are identified as instantaneous peak demand flows and residual pressures. The instantaneous peak demand low pressures are theoretical only and may have never been experienced by any customer.

The software can also be used to calculate the estimated average pressures and flows for a peak day situation. These results are identified as residual pressures and flows for a 20 hour period. In addition to providing the calculated average residual pressures and flows for the distribution system, the average 20 hour period is also useful in estimating the effects upon tank levels and pumping capabilities. A 20 hour period (as opposed to a 24 hour period) is used to provide some margin for the possibility of peak day demands being higher than projected.

The hydraulic model was updated for Sioux Rural Water in early 2013 as part of the PER agreement, and the model is based upon water use in the year 2012. 2012 was notably the highest recent usage period for many systems in the region, including Sioux Rural Water. 2012 had high peak day usage and high sales volumes for the year. When performing hydraulic modeling for rural water systems, the factors included in the method of calculating the instantaneous peak demands are as important as the actual water use assigned to customers. The factors are based upon actual usage patterns of the water system and also upon long-term experience in modeling rural water systems.

WATERTOWN AREA REVIEW

A hydraulic modeling effort was performed in order to review the condition of the existing distribution system and the effect of the proposed improvements, as well as the effect upon the system with additional customers added. Two areas were reviewed specifically. The first area is generally described as the "West Side" and is the area between Lake Kampeska and Pelican Lake in Lake Township and Pelican Township. The second area considered is immediately east of Interstate 29, generally along Highway 212, or more generally described as the "East Side". The results of the modeling effort are summarized in a memo dated January 25, 2016 and is included in Appendix E.

When considering additional customers in these areas for hydraulic modeling purposes, it was assumed that the annual average monthly water use for additional customers would be 5,500 gallons per month. This is considered a very conservative approach as the actual annual average of equivalent customers in the area is 4,700 gallons per month for year 2012. For revenue projection purposes, it would be conservative to use a number less than 4,700 gallons per month because 2012 was a high sales year (about 14% higher than adjoining years). It is recommended that 4,100 gallons per month be used for an annual average for revenue projection purposes.

West Side Review

Sheets 1-3 of the memo show the existing system under instantaneous peak demand conditions. The results indicate that there can be low residual pressures experienced in the area. This is one of the primary reasons why the system intends to make improvements to the area with the proposed eight miles of 8" pipeline as previously discussed.

Sheets 4-6 display the anticipated residual pressures and flows under instantaneous peak demand conditions after the proposed improvements project is complete. This demonstrates that the improvements project will be effective in providing additional residual pressure to the area.

Sheets 7-9 indicate the residual pressures and flows for instantaneous peak demand conditions after several additional customers are added in the area and two additional minor water main improvements are complete. The additional water customers are listed on the first page of the memo in Appendix E, and they generally include the Pelican View Estates, Kaks Addition and a few small businesses in the area. The modeling results indicate that with the additional customers added to the system, acceptable residual pressures and flows can be provided to the area.

For each of the three scenarios presented above, the average 20 hour pressures and flows were also calculated. These results are displayed on Sheets 18-26 and indicate that the system has adequate pumping and distribution capacity to meet peak day demands of existing and additional customers.

East Side Review

The hydraulics memo addresses the distribution area on the east side of Watertown beginning with Sheet 10. Sheets 10 and 11 show the instantaneous peak demand conditions and the resulting pressures and flows for the existing system before the improvements project is completed.

Sheets 12 and 13 show the instantaneous peak demand conditions with additional customers added in the area before the improvements project is complete. The additional customers on the east side of Watertown are listed on Page 1 of the memo and generally include several small businesses in the area. The modeling results indicate that the identified additional customers can be adequately served by the existing water system.

Sheets 14 and 15 show the instantaneous peak demand conditions for the existing system with the proposed improvements project completed.

Sheets 16 and 17 show the instantaneous peak demand results with the new customers added, with minor improvements and the proposed improvements project is complete. Again, the results indicate that the additional customers can be added to the system while providing adequate pressures and flows to the system.

The average flows and pressures for a 20 hour period for the east side of Watertown are shown on Sheets 27-34. The results indicate that the system has adequate pumping and distribution capacity to meet peak day demands of existing and additional customers.

Generally speaking, the Sioux Rural Water distribution system can easily accommodate additional customers on the east side because of the previous investment made in several miles of 6-inch pipe along the east side of Interstate 90.

SIOUX WATER TREATMENT PLANT REVIEW

Sioux Rural Water System operates two water treatment plants. The south water treatment plant is called the Castlewood Water Treatment Plant and generally serves the southern and western parts of the system. The north water treatment plant is called the Sioux Water Treatment Plant and it generally serves the northern and northeastern parts of the system.

When considering the production needs of the Sioux Water Treatment Plant, more recent data was considered than that which was available at the time the original PER was completed. The PER generally contained data from 2009 to mid-2012. More recent data includes data through September 2015. Significant effort has been made over the last couple of years to control water loss, which has resulted in more water being available for delivery. Peak usage days in the spring of 2014 were similar to the peak usage days in 2012; however, the 3-day and 5-day moving averages were higher in the spring of 2014 than they were in 2012. Therefore the spring of 2014 data was used in reviewing the Sioux Water Treatment Plant capacity.

The Sioux Water Treatment Plant serves the area surrounding Watertown. The water treatment plant consists of granular media filters for iron and manganese reduction. The hydraulic capacity of the water treatment plant is 600 gallons per minute (gpm). The current raw water quality and the current effectiveness of the treatment process limit the plant capacity. The plant can produce 400 gpm with consistent good finished water quality. The plant can be operated at 450 gpm with only slight increases in finished water manganese levels. The effects of higher manganese levels are aesthetic only and are generally not problematic during high usage periods. Operated at 450 gpm over a 22 hour period, the daily treatment capacity of the Sioux Water Treatment Plant is 594,000 gallons per day. A 20 to 22 hour day is commonly used when evaluating water treatment plant capacity; this allows two to four hours per day to backwash filters and provide miscellaneous maintenance as required.

Design guidelines recommend that a water system provide finished water storage equal to or greater than an average day water demand. Recent average day demands from the Sioux WTP have been approximately 350,000 gallons per day. Total storage in the Sioux WTP service area, including reservoirs at the WTP and water towers in the distribution system, is 468,000 gallons. This exceeds the recommended amount and allows Sioux Rural Water to meet daily fluctuations in water demands and to meet multi-day high demand periods.

The 176 additional customers previously discussed in the hydraulic modeling effort represent an added water demand of approximately 32,500 gallons on an average day and approximately 93,000 gallons on a peak day. Given the current treatment capacity of 450 gpm, and given the available system storage, approximately 30-35 additional customers of the type described could be added to the system without exceeding source capacity. In order for more than 30-35 customers to be added, the source capacity would need to be increased.

Four primary alternatives can be considered for expanding source capacity for Sioux Rural Water: optimize and improve existing facilities, finding locations for wells with better water quality, adding filters and obtaining water supply from other entities. Each is discussed in more detail below.

Optimize and Improve Existing Facilities

Some improvements have been made in the last couple of years to improve the effectiveness of the current treatment process. These include filter media replacement, backwash flow rate adjustment, closer monitoring of chemical dosages, etc. Further work could potentially be done to optimize and improve the existing facilities such as: 1) a filter media study to determine if another media type would be more effective, 2) a chemical study to determine if other chemical treatments would be more effective, 3) addition of on-line instrumentation to further improve chemical control, and 4) consider the addition of a larger detention tank specifically designed for settling of iron and manganese in order to reduce the solids loading on the filters. The goal would be to attain consistent good finished water quality at treatment flow rates over 500 gpm.

New Wells with Better Water Quality

The current raw water source for the Sioux Water Treatment Plant has high levels of iron and manganese which the limits the filter capacity to 400-450 gpm and requires frequent backwash. If wells could be obtained with lower iron and manganese levels, the filters could potentially be run at a higher capacity (such as 450-550 gpm) and the filters could potentially be run for a longer time period between backwashes, both of which could increase the treatment capacity of the Sioux plant. Project cost and timeline are difficult to estimate due to the variable nature of aquifer systems. The effort could take 1 to 3 years and cost $400,000 to $700,000. Sioux Rural Water is in the beginning phase of implementing this alternative. The addition of two new wells is included in the budget of the currently funded improvements project.

Adding Filters

In previous reports, a filter addition has been identified as a potential improvement at the Sioux Water Treatment Plant. Adding two more filters would double the treatment capacity to 960,000 gallons per day. Additional wells would also be needed to increase source capacity. A filter addition would be expected to cost $1 million to $1.3 million total project cost, and the time required to complete such a project is expected to be 2 to 4 years.

Obtaining Water Supply from Other Entities

Another alternative for expanding source water capacity is to obtain a treated water supply from another entity. This could consist of purchasing water from a neighboring municipality or rural water system. Project cost would depend up location of facilities and agreements between systems. Timelines for such projects are commonly 1 to 3 years.